CLAIMS

What is claimed is:

1. A method of fabricating a nanotube on a substrate, the method comprising:

(a) attaching a catalyst to a substrate;

(b) heating the catalyst to a predetermined temperature such that a nanotube grows from the catalyst; and

(c) directing a feeding gas over the catalyst in a predetermined direction such that the nanotube grows in the predetermined direction.

2. The method of claim 1 wherein the attaching step comprises patterning the substrate.

3. The method of claim 2 wherein patterning the substrate comprises photolithographic patterning.

4. The method of claim 1 wherein the attaching step comprises dispersing the catalyst on the substrate.

5. The method of claim 1 wherein the attaching step comprises depositing the catalyst on the substrate.

6. The method of claim 1 wherein the catalyst is composed of a material selected from the group consisting of iron, molybdenum, platinum, and combinations thereof.

7. The method of claim 1 wherein the catalyst is monodispersed.

8. The method of claim 1 wherein the catalyst is between about 1 and 6 nanometers in diameter.

9. The method of claim 1 wherein the substrate is composed of a material selected from the group consisting of silicon oxide, silicon, quartz, and combinations thereof.

10. The method of claim 1 wherein the substrate comprises a silicon oxide layer for attachment of the catalyst.

11. The method of claim 10 wherein the silicon oxide layer is about 100 nanometers thick.

12. The method of claim 1 wherein the surface of the substrate comprises a silica layer for attachment of the catalyst.

13. The method of claim 1 wherein the predetermined temperature is between about 800°C and 1050°C.

14. The method of claim 1 wherein the catalyst is heated between about 10 and 20 minutes.

15. The method of claim 1 wherein the feeding gas is composed of a material selected from the group consisting of carbon, hydrogen, carbon monoxide, hydrocarbons, alcohols, hydrocarbon/H_2 mixture, alcohol/ H_2 mixture, and combinations thereof.

16. The method of claim 1 comprising heating the feeding gas to about 700°C before directing the feeding gas over the catalyst.

17. The method of claim 1 further including cutting the nanotubes to a predetermined length.

18. The method of claim 1 applying an electric field to align the nanotubes in the predetermined direction.

19. The method of claim 1 applying a magnetic field to align the nanotubes in the predetermined direction.

20. The method of claim 1 applying a gravity field to align the nanotubes in the predetermined direction.

21. A method of fabricating a nanotube on a substrate, the method comprising:

(a) attaching a catalyst to a substrate;

(b) heating the catalyst to between about 800°C and 1050°C between about 10 and 20 minutes such that a nanotube grows from the catalyst; and

(c) directing a feeding gas over the catalyst in a predetermined direction such that the nanotube grows in the predetermined direction.

22. A system for fabricating a nanotube on a substrate, the system comprising:

(a) a substrate comprising a catalyst attached thereto;

(b) a furnace operable to heat the catalyst to a predetermined temperature such that a nanotube grows from the catalyst; and

(c) a gas blower operable to direct a feeding gas over the catalyst in a predetermined direction such that the nanotubes grow in the predetermined direction.

23. The system of claim 22 wherein the catalyst is composed of a material selected from the group consisting of iron, molybdenum, platinum, and combinations thereof.

24. The system of claim 22 wherein the catalyst is monodispersed.

25. The system of claim 22 wherein the catalyst is between about 1 and 6 nanometers in diameter.

26. The system of claim 22 wherein the substrate is composed of a material selected from the group consisting of silicon oxide, silicon, quartz, and combinations thereof.

27. The system of claim 22 wherein the substrate comprises a silicon oxide layer for attachment of the catalyst.

28. The system of claim 27 wherein the silicon oxide layer is about 100 nanometers thick.

29. The system of claim 22 wherein the surface of the substrate comprises a silica layer for attachment of the catalyst.

30. The system of claim 22 wherein the predetermined temperature is between about 800°C and 1050°C.

31. The system of claim 22 the catalyst is heated between about 10 and 20 minutes.

32. The system of claim 22 wherein the furnace is a first furnace, and comprising a second furnace operable to heat the feeding gas to about 700°C prior to the first furnace directing the feeding gas over the catalyst.

33. The system of claim 22 wherein the feeding gas is composed of a material selected from the group consisting of carbon, hydrogen, carbon monoxide, hydrocarbons, alcohols, hydrocarbon/H_2 mixture, alcohol/ H_2 mixture, and combinations thereof.

34. The system of claim 22 comprising a cutting tool for cutting the nanotubes to a predetermined length.

35. A system for fabricating a nanotube on a substrate, the system comprising:

(a) a substrate comprising a catalyst attached thereto; and

(b) a furnace operable to heat the catalyst to between about 800°C and 1050°C for between about 10 and 20 minutes such that a nanotube grows from the catalyst; and

(c) a gas blower operable to direct a feeding gas over the catalyst in a predetermined direction such that the nanotubes grow in the predetermined direction.

36. A method of fabricating a nanotubes on a substrate, the method comprising:

(a) attaching a first catalyst to a substrate;

(b) heating the first catalyst to a first predetermined temperature such that a first nanotube grows from the first catalyst;

(c) directing a first feeding gas over the first catalyst in a first predetermined direction such that the first nanotube grows in the first predetermined direction;

(d) attaching a second catalyst to the substrate;

(e) heating the second catalyst to a second predetermined temperature such that a second nanotube grows from the first catalyst; and

(f) directing a second feeding gas over the second catalyst in a second predetermined direction such that the second nanotube grows in the second predetermined direction, wherein the second predetermined direction is a different direction than the first predetermined direction.

37. The method of claim 36 wherein the first and second catalysts are composed of a material selected from the group consisting of iron, molybdenum, platinum, and combinations thereof.

38. The method of claim 36 wherein the first and second catalysts are monodispersed.

39. The method of claim 36 wherein the first and second catalysts are between about 1 and 6 nanometers in diameter.

40. The method of claim 1 wherein the substrate is composed of a material selected from the group consisting of silicon oxide, silicon, quartz, and combinations thereof.

41. The method of claim 36 wherein the substrate comprises a silicon oxide layer for attachment of the catalyst.

42. The method of claim 41 wherein the silicon oxide layer is about 100 nanometers thick.

43. The method of claim 36 wherein the surface of the substrate comprises a silica layer for attachment of the catalyst.

44. The method of claim 36 wherein the first and second predetermined temperatures are between about 800°C and 1050°C.

45. The method of claim 36 wherein the first and second catalysts are heated between about 10 and 20 minutes.

46. The method of claim 36 wherein the first and second feeding gases are composed of a material selected from the group consisting of carbon, hydrogen, carbon monoxide, hydrocarbons, alcohols, hydrocarbon/H_2 mixture, alcohol/ H_2 mixture, and combinations thereof.

47. The method of claim 36 comprising heating the first and second feeding gases to about 700°C before directing the first and second feeding gases over the first and second catalyst, respectively.

48. A system for fabricating nanotubes on a substrate, the system comprising:

(a) a substrate comprising a first and second catalyst attached thereto;

(b) a furnace operable to heat the first catalyst to a first predetermined temperature such that a first nanotube grows from the first catalyst, and operable to heat the second catalyst to a second predetermined temperature such that a second nanotube grows from the second catalyst; and

(c) a gas blower operable to direct a first feeding gas over the first catalyst in a first predetermined direction such that the first nanotube grows in the first predetermined direction, operable direct a second feeding gas over the second catalyst in a second predetermined direction such that the second nanotube grows in the second predetermined direction, and wherein the second

predetermined direction is a different direction than the first predetermined direction.

49. The system of claim 48 wherein the first and second catalysts are composed of a material selected from the group consisting of iron, molybdenum, platinum, and combinations thereof.

50. The system of claim 48 wherein the first and second catalysts are monodispersed.

51. The system of claim 48 wherein the first and second catalysts are between about 1 and 6 nanometers in diameter.

52. The system of claim 48 wherein the substrate is composed of a material selected from the group consisting of silicon oxide, silicon, quartz, and combinations thereof.

53. The system of claim 48 wherein the substrate comprises a silicon oxide layer for attachment of the catalyst.

54. The system of claim 53 wherein the silicon oxide layer is about 100 nanometers thick.

55. The system of claim 48 wherein the surface of the substrate comprises a silica layer for attachment of the catalyst.

56. The system of claim 48 wherein the first and second predetermined temperatures are between about 800°C and 1050°C.

57. The system of claim 48 wherein the first and second catalysts are heated between about 10 and 20 minutes.

58. The system of claim 48 wherein the first and second feeding gases are composed of a material selected from the group consisting of carbon,

hydrogen, carbon monoxide, hydrocarbons, alcohols, hydrocarbon/H_2 mixture, alcohol/ H_2 mixture, and combinations thereof.

59. The system of claim 48 comprising heating the first and second feeding gases to about 700°C before directing the first and second feeding gases over the first and second catalyst, respectively.

60. A method of fabricating nanotubes on a substrate, the method comprising:

(a) providing a substrate comprising a surface and a plurality of suspension structures attached to the surface, wherein the suspension structures are separated by an area of the surface of the substrate;

(b) attaching a first plurality of catalysts to the surface area of the substrate between the separated suspension structures;

(c) heating the first plurality of catalysts to a first predetermined temperature such that a first plurality of nanotubes grow from the first plurality of catalysts;

(d) directing a first feeding gas over the first plurality of catalysts in a first predetermined direction such that the first plurality of nanotubes grow in the first predetermined direction;

(e) attaching a second plurality of catalysts to the plurality of suspension structures;

(f) heating the second plurality of catalysts to a second predetermined temperature such that a second plurality of nanotubes grow from the first plurality of catalysts; and

(g) directing a second feeding gas over the second plurality of catalysts in a second predetermined direction such that the second plurality of nanotubes grow in the second predetermined direction, wherein the second predetermined direction is a different direction than the first predetermined direction.

61. The method of claim 60 wherein the first and second catalysts are composed of a material selected from the group consisting of iron, molybdenum, platinum, and combinations thereof.

62. The method of claim 60 wherein the first and second predetermined temperatures are between about 800°C and 1050°C.

63. The method of claim 60 wherein the first and second catalysts are heated between about 10 and 20 minutes.

64. The method of claim 60 wherein the first and second feeding gases are composed of a material selected from the group consisting of carbon, hydrogen, carbon monoxide, hydrocarbons, alcohols, hydrocarbon/H_2 mixture, alcohol/ H_2 mixture, and combinations thereof.

65. The method of claim 60 comprising heating the first and second feeding gases to about 700°C before directing the first and second feeding gases over the first and second catalyst, respectively.

66. The method of claim 60 wherein the suspension structures extend in a substantially straight direction and about parallel to one another along the surface of the substrate.

67. The method of claim 61 wherein the first gas flow is in the substantially straight direction of the suspension structures such that the first plurality

of nanotubes grow along the surface area of the substrate between the separated suspension structures.

68. The method of claim 67 wherein the second gas flow is in a direction about perpendicular to the substantially straight direction of the suspension structures such that the second plurality of nanotubes grow across the separated suspension structures.